A How-to Guide for

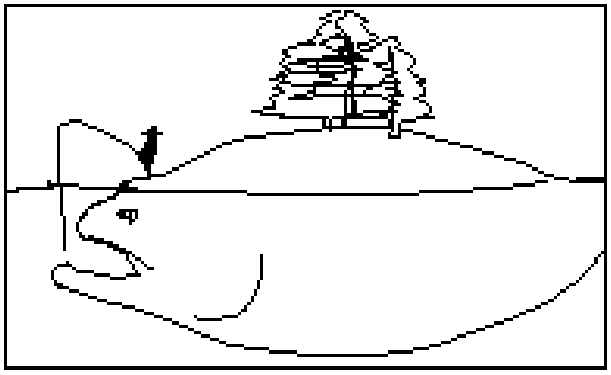
Risk Management in the OPS

This on-line guide is to be used with the Risk Management Framework

State Objectives → Identify Risks → Assess (Measure) → Plan & Take Action → Monitor & Report

Glossary

- How to use the risk management process
- How to clarify your objectives
- How to identify your risks
- How to assess your risks
- How to develop a risk profile
- How to develop an action plan for managing risk



This guide is written for OPS employees as a beginner's guide to implementing risk management.

The risk management field is extensive; as a discipline it spans several centuries of practice. The beneficiaries of the basic concepts are found in a multitude of professional functions including science, engineering, policy, medicine and finance. Some practices are intentionally simplistic, others are very complex. This How-to Guide is for organizations in the OPS and their teams who want to realize the strategic benefits of a systematic and integrated approach to risk management. It is a beginning.

For more information and resources contact The Office of the Provincial Controller (416) 325-8084, or review the resource list appended to this document.

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How-to Guide for Risk Management in the OPS:

In this guide you will learn:

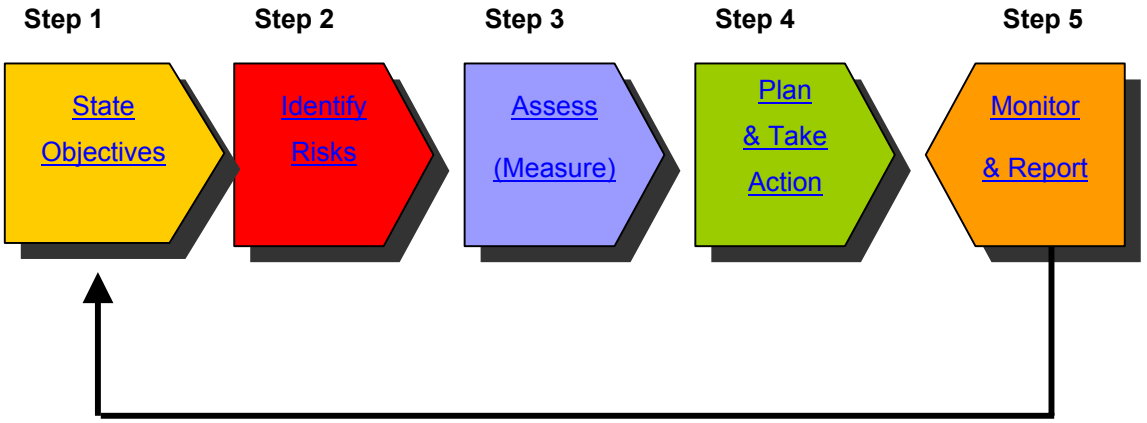
- How to use the risk management process
- **Step 1:** How to clarify your objectives
- **Step 2:** How to identify your risks
    - How to identify the source/s of risk and the links between risks
    - How to determine risk tolerance
- **Step 3:** How to assess (measure) risks
    - How to Develop a Risk Profile
- **Step 4:** How to develop an action plan for managing risk
- **Step 5:** How to Monitor Risk
- Where to Learn More (Resources)
- Glossary
- Hazard Risk Management Process Example (II&E)
- Ministry of Education Risk Identification Template

How to Use the Risk Management Process:

In the following diagram we illustrate a simple, but systematic process for incorporating risk management into the decision-making process for all public sector activities. As this is a very basic process, individual ministries and agencies may wish to adapt the process to their needs by augmenting the following five stages:

Figure 1

Basic Risk Management Process for the OPS



Click on each box to move to the next stage

"When we take risks—whether institutionally or individually—we have to be good, extremely good and credible."

From a speech given by Andromache Karakatsanis, July 2000

Starting with this simple risk management process, some Ministries have customized these to reflect the risk management needs of their specific mandates e.g. MOE uses the Quality Service Model to identify risks.

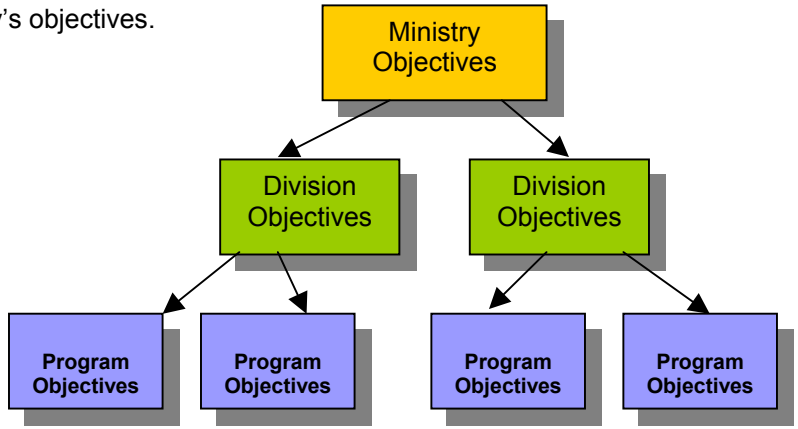
The word "risk" comes from the Italian 'rischiare" which means to dare. It implies a choice of at least two outcomes…decision-making.

Step 1

How to Clarify Your Program Objectives

Objectives are the reference points for determining the performance of our strategies and service delivery. Explicitly stating your Ministry's or agency's objectives provides a context for determining the risks to meeting those objectives. It is important to state objectives so that everyone has a clear understanding of the objectives of the organization or the project.

We start with definition of the organizational objectives that flow from Government priorities and Ministry objectives. Every ministry, [and agency] division, branch department and program will have its own specific sub-set of objectives. Your program objectives cascade from the ministry's objectives and are directly linked to the ministry's objectives.



A good test of your understanding of your program's objectives is to ask yourself "how does this relate to the ministry's objectives?

An objective is a measurable goal. One objective at the Ministry of Finance is to provide timely, reliable and accurate financial information to the citizens of Ontario. An **outcome** of this objective is fiscal transparency and accountability benefits to the public. People know where money is spent. An **output** is what is produced, such as those blue books … Public Accounts.

Objectives are measurable goals. Explicit objectives are those stated in the business plan of the Ministry [or agency]. Implicit objectives are those inherent or assumed in any organization. For example, the safety of all employees is an example of an implicit objective.

Tip: *Check your ministry's intranet site for its business plans to see the desired objectives and outcomes.*

*An **objective** is a measurable goal*

*An **outcome** is the intended benefit to the public.*

*An **output** is what is produced.*

Why not discuss your group/project objectives with the members of your team? How do your objectives relate to your Ministry's objectives?

Step2

How to Identify Risks:

In the OPS, we define a risk as:

> ***An uncertainty…a risk is a potential opportunity or threat to an organization's ability to meet its objectives.***

Thus, risks encompass all potential uncertainties, obstacles, events, hazards, surprises as well as opportunities affecting the ability of the organization to achieve its objectives.

A simple exercise for identifying risks to a program:

1. **List each program objective on the top of a page** (e.g. an explicit objective of the Ministry of Natural Resources is ecological sustainability). Number the objectives, if they are clearly prioritized by the Government;
2. For each objective, brain storm with your team as to
   - The threats that could impact on the Ministry's ability to achieve the objective in relation to your program,
   - Repeat the exercise for the opportunities.
3. **If you get stuck:**
   - Ask: "what could go wrong? " or "what could make things better?" or
   - Consider using an inventory of risk categories: environmental, legal, political, financial, operational, ecological, (review our list), or
   - Scenario analysis, or
   - Review the results of a recent audit, or
   - Use flow charts or process diagrams to map your activity or program, or
   - Look at the Ministry of Education Risk Identification template in Appendix 3;
4. **Review** the categories of risk to make sure nothing is missed.
5. **Sources:** Consider the sources of risk and link those that may drive or create other risks e.g. changes in demographics or the economy might change the demand for your service;
6. **Timing:** Is it a one-time risk or an on-going risk?

We know one high performance team in the OPS where the leader starts every meeting with a statement of the team's objectives. It helps them to prioritize and perform.

A risk can be both positive and negative…uncertainties have upside and downside risk.

The objective of the Integrated Justice Project is to improve safety and provide Ontarians with better access to justice. There is an opportunity (positive risk) in the electronic linking of all partners in the justice system. What are the temporary downside risks?

Ask: "what could go wrong?" or "what could make things better?"

Determining whether a risk is a one-time event or an on-going risk is critical to determining the appropriate risk assessment tool.

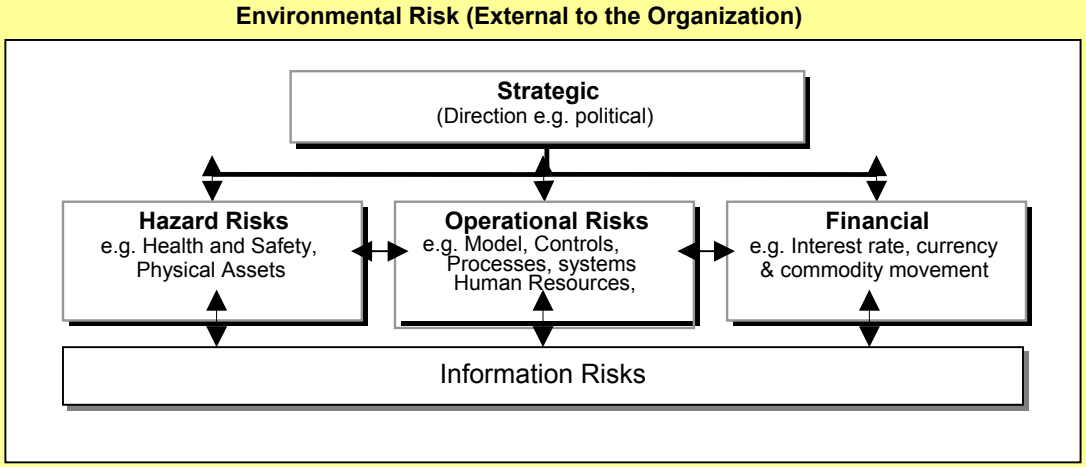
Specific Activity Exception: If you manage hazards:

Regulation or statute defines some risks, particularly threats to public health and safety. The risk identification process for such risks is also aided both by trained inspectors, examiners, and investigators, and often by professional and international standards. Examples include: public exposure to chemicals in the environment or in food, transportation accidents, accidents in industrial facilities or construction sites, tax evasion, or maltreatment of children in foster care homes. If the program you manage is governed by such standards or includes threats such as these, you may find the attached description of Hazard Risk Management a helpful example. (See II&E Risk Management Process for Hazards).

Hazard risk management usually refers to a category of threats to health and safety or loss whose standards are set statute or regulation. Compliance is monitored by government inspectors.

Risk Categories

Most categories of risk fall within a hierarchy that distinguishes internal from external risks and risk pertaining to direction (strategic risk) from risks pertaining to implementation such as hazard, operational and financial risks. Information risk is common to them all.



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External Risks

- **Environmental:** Uncertainty driven by changes in: economy, demographics and federal policy

Internal Risks

Direction:

- **Strategic:** Uncertainties driven by government policy, budget constraints, changes in customers' needs
- **Political:** Changes in government priorities and policies

Implementation:

- **Hazard:**
  - Health and Safety: Physical hazards to citizens and opportunities for improved security and well-being
  - Ecological: Risks to the environment including air, water, earth, forests
- **Operational:** Risk pertaining to how we manage operations and deliver services including human resources, processes, suppliers, systems, or security
- **Financial:** e.g. financial market rates, volatility, capital markets access, fraud
- **Informational:** errors or improvements in forecasting, and the risks related to relevance, reliability, and timeliness of information

The adjacent categories break these down further

We believe that the more tools we have to understand risk, the better our decisions will be. Thus, we do not advocate one tool over another. Rather we suggest that you experiment with these tools and search for others that will best map your decisions and help you to make decisions that achieve objectives.

How to Identify Sources of Risk and Links Between Risks

The source of the risk is often a key as to how the risk can be managed. It is also an indicator of the impact the risk might have outside your program.

Sometimes a series of questions is all that is needed to deduce the source and its links (the Intuitive Method). Sometimes other tools are needed. We have found that the visual nature of an influence diagram

can be helpful, particularly when a group undertakes the exercise. It is also able to accommodate multiple objectives. We give two examples of influence diagrams: a simple introduction and another more complex example that pertain to actual OPS program decision in the Ministry of Natural Resources.

The Intuitive Method-Questions you might ask yourself or your team:

1. What is the objective?
2. What is the risk (opportunity or threat) to our ability to achieve the specific objective?
3. What causes that risk? Another risk or uncertainty? (Call this risk the "source risk")
4. If the source risk was eliminated, would the identified risk also be eliminated?
5. If the source risk was managed (mitigated, hedged, transformed) would it create other risks in this program? Other programs? Other Ministries?

A Tool: Influence Diagrams

Influence diagrams present a decision in a simple, graphical form. Decisions, chance events and payoffs (values) are drawn as shapes (called nodes) and are connected by arrows (called arcs) which define their relationship to each other. In this way, a complex decision may be reduced to a few shapes and lines. Influence diagrams are excellent for showing the relationship between events and the general structure of a decision clearly and concisely. An influence diagram is also a tool that could be used to analyse the relationship of cost drivers as you prepare your annual business plan.

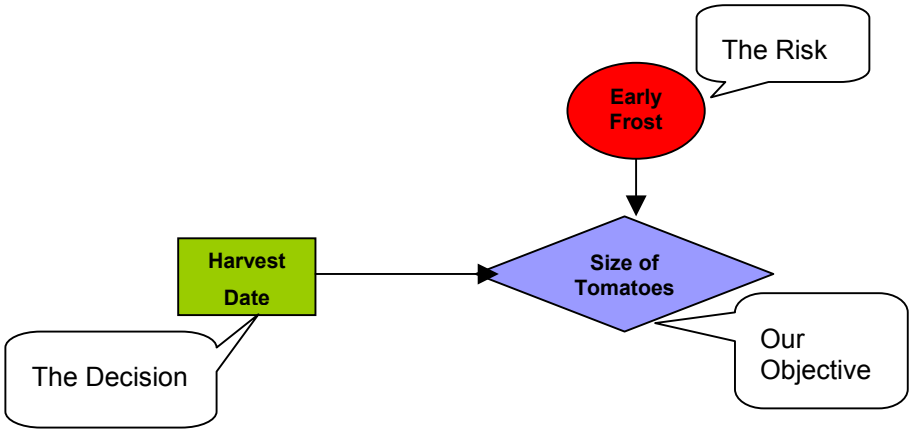
Structuring a decision problem can be likened to assembling a jigsaw puzzle. Once the key elements have been identified, one can start to piece them together. Decision problems include three types of elements: *decisions, uncertain events, and objectives*.

Risk-taking is never about throwing caution to the winds. It does not mean we should be careless.

From a speech given by Andromache Karakatsanis, July 2000

Example: When to pick the tomatoes?

Objectives	Risk	Decision
Large crop of big red tomatoes	Frost	When to Pick?



Objectives

Decisions

Uncertain Events

Chances or Risks

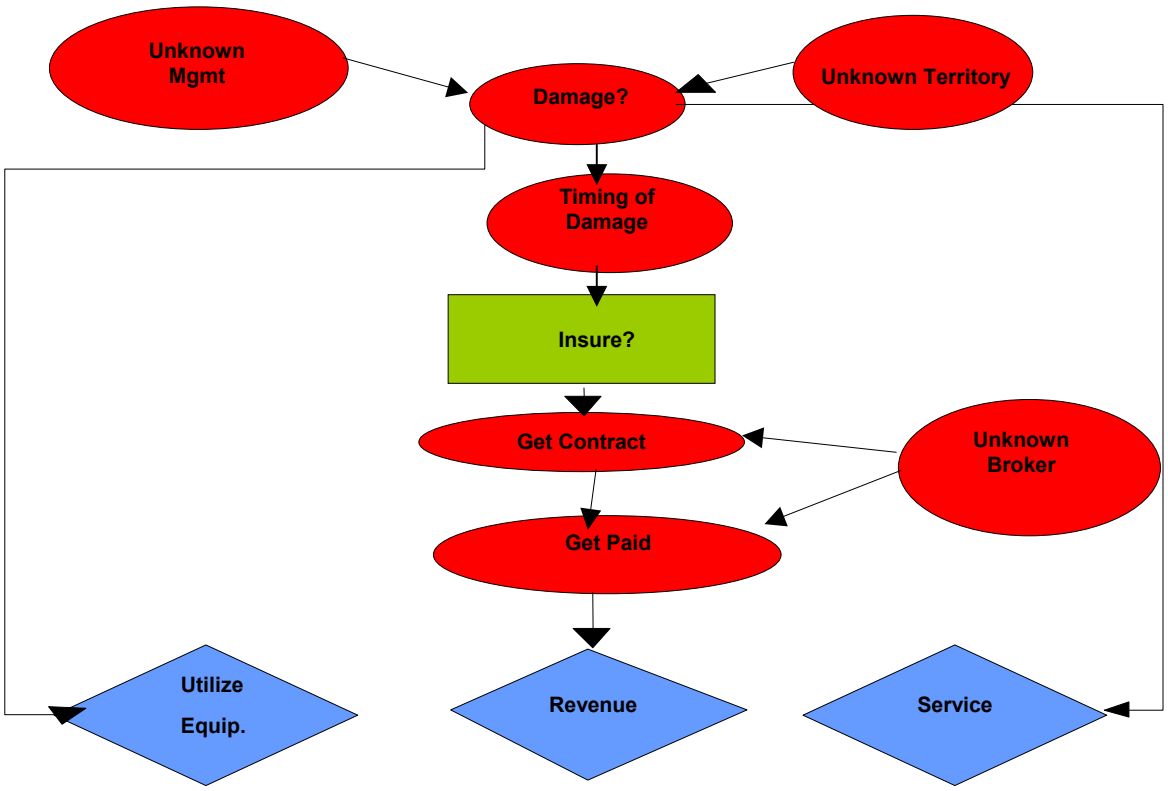
Example: Equipment Insurance

A ministry has safety equipment that is only used in Ontario in the summer. They are approached by an equipment broker with the idea of leasing their equipment to another jurisdiction during the winter when it would not be used. Although the prospect of revenue generation was attractive, the equipment must be available to serve the people of Ontario if needed. The decision to explore the leasing had been made. Our analysis focussed on whether to insure the equipment. We started with an influence diagram to understand the decision:

Note: You could make up your own symbols or use the symbols of operations management. It does not matter as long as you are consistent and your audience understands the symbol. Here we use the symbols used in DPL and PrecisionTree because these are two of the most common decision software programs.

Objectives	Risks	Decisions
1. Serve and protect Ontarians	Damage to equipment	Insure equipment?
2. Generate Revenues	Timing of damage	
3. Utilize Equipment	Get contract	
	Get paid	

Possible Influence Diagram for Equipment Insurance



***Benefits of the Influence Diagram**:*

High level visual map of a complex decision or risk management situation

- *Can accommodate multiple objectives*
- *Can be used with little training*
- *Can be converted to a decision tree*

Drawbacks:

Limited value for risks that require precise quantification to be assessed

Step 3

How is Risk Measured or Assessed?

Measuring the likelihood of the occurrence of the risk and the impact of the risk on our ability to meet our objectives, over time, is critical to determining our risk management strategy. It is important to document your risk assessment to aid in communication, support the planning stage, facilitate monitoring, and to provide an accountability mechanism.

Risk assessment has three main components:

1. **Likelihood** or probability that the risk will happen,
2. **Impact** of the opportunity or threat on our objective, and
3. **Time horizon.** Is this a one-time event? Or a risk that could happen with any frequency over time? Will it happen today or in the future?

Some risk measurement methodologies may be more appropriate than others for capturing the risks to your objectives may. In the following section we ask a series of questions and provide a matrix to help you identify alternative assessment methodologies for the risks you have identified:

- **Frequency:** *How often will the risk occur?*
- **Type of Risk:** *What type of risk is it?* See categories or Glossary for definitions
- **Resources:** *What tools do you have to measure risk?*
- **Capabilities:** *How much does you and your team know about measuring risk?*

For Example: If you are assessing an on-going, operational risk, and you have no software support, and this is the first time you have assessed a risk, then the impact-likelihood matrix would be a good risk method to start with.

"Taking risks—whether collectively or individually carries with it several requirements. To begin with, it requires that we be superbly prepared. We must do our homework, ground ourselves in research. We must know the risks involved and how best to manage them."

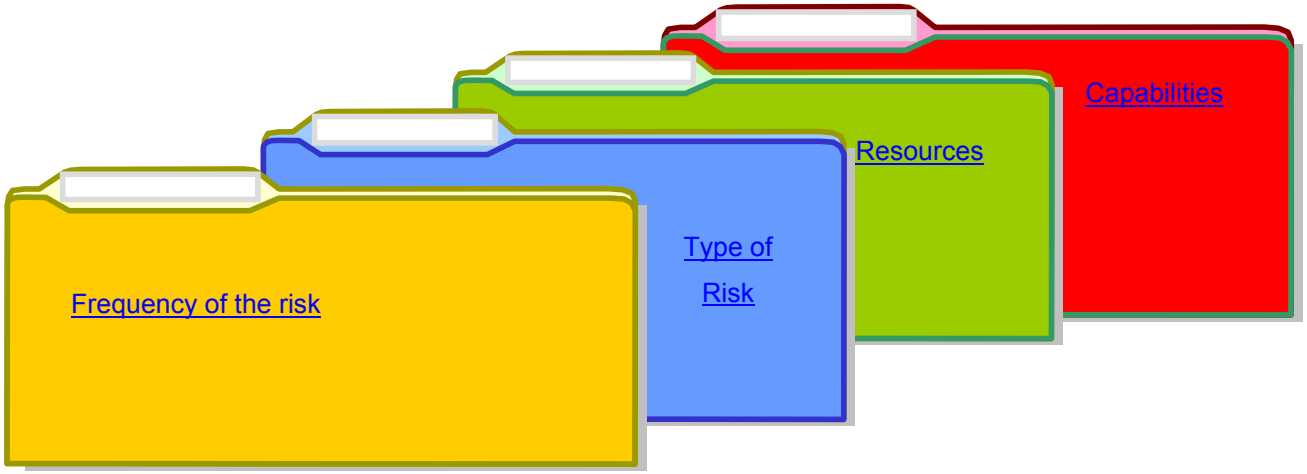
From a speech given by Andromache Karakatsanis, July 2000

Stochastic modelling is a statistically based method of modelling relationships mathematically to simulate what might happen in a given time period. It is used in the OPS by science, economics, treasury and engineering teams.

It is arguable that most of the risks to our objectives are driven by events that happen more than once…e.g. our social services in the Windsor area will be stressed again because the auto industry is driven by economic cycles…This means we can use statistics to forecast likelihood within a given confidence range.

Ask these questions to determine the best risk assessment method for your situation.

Click hyperlink to view definitions.



1. **Frequency:** How often will the risk occur?	*Risk Assessment /Measurement Methodologies*
♦ One- time event or discreet risk:	♦ Delphi Technique (could be used with Matrix) ♦ Cost of regret analysis ♦ Cost of Insuring (or put option) on the event ♦ Scenario analysis
♦ On going or continuous risk	*Risk Assessment /Measurement Methodologies* ♦ Impact Likelihood Matrix ♦ Delphi Technique (could be used with Matrix) ♦ Stochastic Modelling
2. Type of Risk : See categories or Glossary for definitions	♦ Impact Likelihood Matrix ♦ Delphi Technique (could be used with Matrix) ♦ Stochastic Modelling
♦ Environmental Risks	
♦ Strategic Risks	♦ Impact Likelihood Matrix ♦ Delphi Technique (could be used with Matrix) ♦ Stochastic Modelling

♦ Operational Risks	♦ Impact Likelihood Matrix ♦ Delphi Technique (could be used with Matrix) ♦ Stochastic Modelling ♦ Hazard Risk Management Methodologies
♦ Informational Risk	♦ Impact Likelihood Matrix ♦ Delphi Technique (could be used with Matrix) ♦ Stochastic Modelling
♦ Health and Safety Risk	♦ Hazard Risk Management Methodologies ♦ Impact Likelihood Matrix ♦ Delphi Technique (could be used with Matrix) ♦ Stochastic Modelling
♦ Financial Market Risk	♦ Impact Likelihood Matrix ♦ Delphi Technique (could be used with Matrix) ♦ Stochastic Modelling
3. Resources: ***What tools do you have to measure risk?***	*If your resources (systems, human, time) are very limited we would recommend that you start with*
♦ Limited	♦ Impact Likelihood Matrix ♦ Delphi Technique (could be used with Matrix)
♦ Systems, Budget, Human Resources are available	♦ Stochastic Modelling
4. **Capabilities:** *How much does you and your team know about measuring risk?*	*Keep it very simple. Document your assumptions and assessments for future review. Methods you might use include* ♦ Impact-Likelihood Matrix perhaps in combination with the Delphi Technique
♦ Novice	
♦ Knowledgeable	♦ Stochastic Modelling

Impact –Likelihood Matrix

The impact-likelihood matrix has broad application. With this simple intuitive tool you can determine quickly the subjective measurement of a risk so that the appropriate strategy can be determined. E.g. if you find that a risk has a low likelihood and minor impact, it would not be as critical to refine your assessment methodology.

1. Clarify the objectives. (See How-to Clarify Objectives)

2. Identify the risks to individual objectives (opportunities and threats) note: it helps to put only one objective on a page and then list the threats and opportunities to the organization's ability to achieve that objective. (See How-to Identify Risks)

3. Subjectively estimate the probability of the risk happening and call that likelihood.

   Ask: "could the risk happen...never, maybe, or is it happening now?" It is measured as:

   High (very likely, or already happening)
   Medium (possible)
   Low (unlikely)

   The estimate of likelihood will not change in relation to the objective.

4. Then estimate the impact of the risk on the organization's ability to achieve the individual objective:

   Significant or
   Moderate or
   Minor

5. Summarize risk assessments by mapping the risks to each objective in the following chart. Make a chart for each objective.

If we apply the impact/likelihood matrix we can identify some guidelines for the appropriate strategy and relative resource allocation. This mapping could be done for all objectives.

The application is new, but the methods have a history…

In 1654 a French mathematician Pascal, and lawyer, Fermat, analyzed games of chance to develop the mathematical basis for the Theory of Probability on which your likelihood estimate is based.

Later in 1738 Daniel Bernolli introduced the idea that decisions relating to risk involve not only calculations of probability (likelihood) but also the value of the consequences (impact). This idea became Utility Theory.

Objective:		**Likelihood**		
		Low	Medium	High
Impact	Significant			
	Moderate			
	Minor			

Risk Mapping

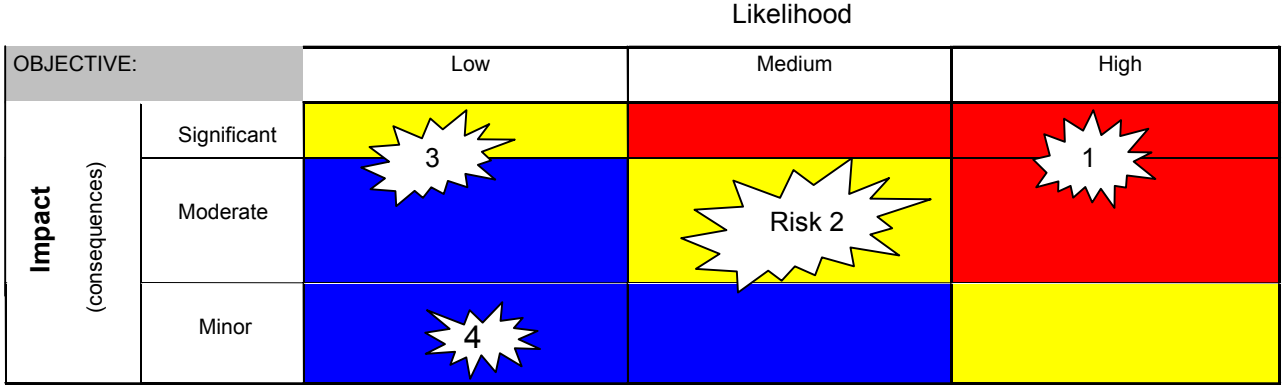
Purpose: risk identification and prioritisation

This technique, though somewhat subjective, provides an effective, uniform and powerful means of identifying and prioritising risks. Program managers and their teams assess their identified risks in terms of impact on ministry objectives and the likelihood or probability of the event happening and insert those assessments in the impact likelihood matrix. "Significant-High" rated risks are the highest priority noted by the red zone. As noted in Strategy, these risks require the involvement of senior management with a detailed plan to manage the risk.

Highest priority

2nd priority

Lowest priority



Risk 1: An opportunity with a significant impact and high likelihood

Risk 2: A threat with a moderate impact and medium likelihood

Risk 3: A threat with a significant impact and a low likelihood

Risk 4: A threat with a minor impact and a low likelihood

A risk map is a useful tool for communicating a summary of an organization's risks.

Benefits of Risk Maps:

- *Simple, subjective, low technology, little training required, widely used.*
- *Focuses attention on the high priority risks*
- *Aligns objectives with the management of risks.*

Drawbacks

- *Simple and subjective, does not show interdependence of risks or project impact or likelihood forward in terms of time horizon*
- *Does not accommodate for competing or multiple objectives*
- *Does not accommodate for different impact assessments of different objectives.*

Cost of Regret

Most risks that we manage in the OPS have a history that allows us to apply statistical methods to forecast the likelihood (even subjectively) of re-occurrence. If the event has never happened before, likelihood (probability) cannot be estimated. Assessment of a one-time risk thus, requires a different measurement methodology.

The measurement of the regret of a one-time risk is the cost of insuring that downside or the cost of preventing the risk.

The impact of a one-time risk is often underestimated by using methods designed for decisions such as the netting of costs and benefits. Thus, for one-time risks we suggest an estimation based upon the “cost of regret". This is a conceptual application of the marking-to-the-future methodology developed by Dr. Ron Dembo (1998). It also linked Dr. Charles Handy’s early work with risk (1923).

The measurement of the regret of a one-time risk is the cost of insuring that downside (or upside) or the cost of preventing (or precipitating) the risk. Typically, “preventing” the risk, means transforming the risk into another risk. As the assessments of a one-time risk tend to be significant and urgent, it is very important to distinguish them from on-going risks. As with all risk assessments, it is also important to document the process and assumptions used.

Scenario Analysis:

Scenario analysis is a risk assessment and strategy testing technique. Ask yourself or your team: *what is the worst /best event or series of events that could happen?* History is a good source for such scenarios. For example, what would happen to quality service targets at the drivers’ licence offices if the computer data base was down for a day?

Delphi Technique

The Delphi technique is the use of a group of knowledgeable individuals to arrive at an estimate of the outcome and likelihood of an uncertain situation. There are several methods of eliciting subjective estimates from your colleagues: direct, conceptual (use analogies), betting method, and the comparison lottery methods. A decision-tree can be a useful visual aid for the latter two methods.

Electronic polling processes are examples of the delphi technique.

Stochastic Modelling

Models are a way of structuring our decisions and risk analysis to make them more organized and to provide an opportunity for more in-depth analysis by simulating the future. Stochastic modelling uses statistics e.g. collecting the pattern of Health Hotline requests over a time horizon. Although there are several methods, commonly that data is compared with other data, e.g. interest rates over the same period, and the relationship between the two events is determined (regression analysis). This stage is repeated with other types of data until a predictive model (algorithm or variance-co-variance matrix) is built on this information. Using history to forecast the future, the model would determine an outcome with a confidence level (likelihood). Given those data relationships, a Monte Carlo driver would simulate uncertain events within the prescribed constraints. Monte Carlo Simulation uses a random number generator to build a picture of the frequency of a risk given a series of constraints or historic relationships. Applying the stochastic technique with the random number generator tool, gives us applications such as Value-at-Risk. VaR is a stochastic application that is commonly used as a measure of risk in the financial markets. Simply, it is the maximum expected loss in a given portfolio, over a given time horizon at a given confidence rate. Similar methodologies are used by other disciplines in many ministries.

It is beyond the scope of this introductory document to provide instruction on how to stochastically model your risks, use Monte Carlo simulation or conduct value-at-risk analysis (VaR). However, these are tools and methods that are in common use for the assessment of many different types of risk even in the OPS. The statistical base of this analysis means that a data warehouse or a history of the risk frequency and its impact is a pre-requisite to building the model.

How to Define Risk Tolerance

Determining and communicating an organization's risk tolerance is an essential part of managing risk. In the public sector, risk tolerance is a function of:

- The impact of the identified risk on (Ministry) objectives,
- Our organizational ability and capacity to influence the outcome of the risk and
- Stakeholder consultation as represented by the Deputy (Minister and Government)

Assessment of risks to ministry objectives will determine, even subjectively, the impact and likelihood of the risk on a particular objective, and will suggest the level and degree of consultation required to define the risk tolerance level. In some cases these are limits are defined by regulation or policy, others by Government prioritization of objectives, and others by consultation with stakeholders/ representatives. For risks with a significant impact, consultation with senior managers, the Deputy and in some cases, the Minister or samples of stakeholders can be a useful method of estimating stakeholders' needs and expectations. Deputy Ministers have responsibility for the articulation of risk tolerance in relation to the Government's agenda. All risk limits approved or implied by business plans and programs should reflect this risk tolerance.

Using the tools illustrated in this guide, we suggest the following method to determine risk tolerance:

1. **Assess the risks** to the objective to determine likelihood and impact;
2. **Map the Risks** to plot the risks and note those which are the highest priority (red) , medium priority (yellow), and lowest priority (blue);
3. **Consult** with Ministry senior management as to the degree of consultation appropriate for the risk (e.g. Should we consult with the Deputy as stakeholder representative etc.?) If a broader consultation is advised, you might consider methods such as: voting technology, or focus groups or surveys to determine the risk tolerance for specific risks.

Risk tolerance is about choices and our comfort with possible outcomes.

As a society we have very limited to zero risk tolerance for direct threats to public health and safety.

Remember that although your personal risk tolerance is important, it is not necessarily the best gauge of other stakeholders' risk tolerance.

Subjective methods for determining risk tolerance work too. You do not always need to put a number on the level.

4. **Determine Risk Tolerance:** Using the risk map as a visual tool, ask the appropriate stakeholder representative what their risk tolerance level is for the high priority risks, and follow with the other assessed risks.
   - High risk tolerance = this risk is not that critical to the stakeholder.
   - Moderate risk tolerance = the risk is important, but not critical.
   - Low risk tolerance = this risk is very critical.

Risk tolerance levels can change over time.

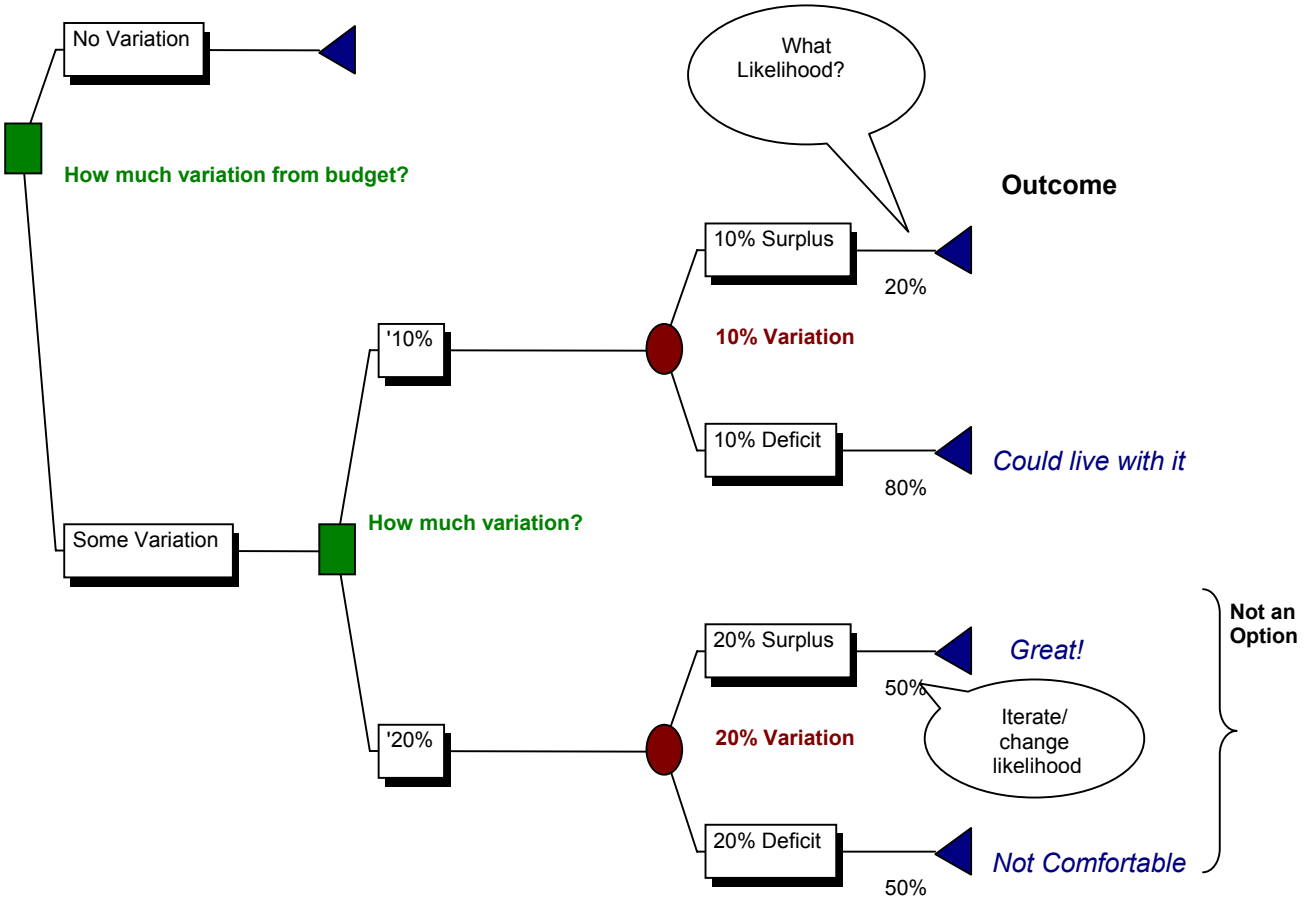
If you find that there is a high risk tolerance for a risk assessed high priority (red zone), it may be appropriate to reposition the risk in your map. Similarly, there may be very low risk tolerance for risks that are rated low likelihood but significant impact that also need to be repositioned with this new information.

A decision tree could also be used as a tool for determining risk tolerance for a sequence of risks.

A decision tree can be used as a tool to map out the relationship between objectives, decisions and risks. A decision tree breaks down a series of events into smaller, simpler more manageable independent segments. These segments are represented as branches of a tree.

EXAMPLE:

An agency board of directors, as representatives of the public interest, was asked to define its risk tolerance for financial market risk. The organization purchased products in foreign currencies. The exchange rate of the currencies varied at times. The potential existed for the exchange rates to increase from budget projections and cost more, or to decrease and result in a surplus relative to budget. The question became: how much risk tolerance did the board have for fluctuations in currency expenses relative to the budget? Would they prefer a 100% chance of matching the budget? Or a 50% chance of having a surplus? What about only a 20% chance of a surplus, and an 80% chance of a loss? The variables and likelihood were changed or iterated to see at what point the board was uncomfortable with the outcome. Using a simple decision tree to map out the alternatives and the outcomes, the managers presented the board with choices to test their consensus risk tolerance. (Remember the percentages for the branch must add to 100%).



We use decision trees in the modern controllership course- Risk Management: A Tool for Better Decisions. Enroll if you want to learn more about these tools. http://intra.mc.fin.gov.on.ca/scripts/index.asp

The board compared those outcomes with their objectives and determined that at this time they had very limited risk tolerance. Thus, they agreed that most of the foreign currency requirements should be hedged in advance, leaving a small requirement for management to optimize.

The Steps Used in the Decision Tree Example:

1. Define the decision or issue, the objectives and the uncertainties
2. Understand the links and drivers between risks
3. Map the decisions and risks
4. Iterate the likelihoods of the events or uncertainties happening
5. Ask where is the comfort level?
6. If the stakeholders cannot live with the possibility of the outcome, they have zero risk tolerance.

As the risk is transformed by the risk tolerance level into another risk, repeat the process with the associated risks (e.g. cost).

How to Develop a Risk Profile

A risk profile is a document that summarizes your risk analysis. It prioritizes the risks and focuses the planning to manage the risks. The steps we follow included:

1. Clarify ministry objectives
2. Identify risks to those objectives, through environmental scanning, brainstorming
3. Map risk sources or drivers and links
4. Assess the risks: likelihood, impact, and time horizon of the risks. A risk map is a good way to summarize your analysis.
5. Determine the risk tolerance for the risks.
6. Rank the risks in terms of impact and likelihood and risk tolerance
7. Re-prioritize the risks
8. Assess the organization's ability to manage these risks. (Controller's capacity checklist)

Now we can prepare a strategy for managing the risk.

Step 4

How to Develop a Risk Management Strategy

Based on the risk profile:

1. Define objectives and expected outcomes for each risk, in both the short and long term: What do we want to happen?

2. Develop options or alternatives for managing the risk: Use the following strategic matrix to determine what is the most appropriate strategy.

3. Analyze the alternatives

4. Test the strategy.

We observe three strategic alternatives for management of identified and assessed risks:

- **Hedge** or insure against or for the outcome;

- **Mitigate** the likelihood and/or impact of the risk with strategies such as: policy and regulation and its enforcement; or monitor the risk; or incorporate the risk into detailed contingency planning.

- **Transform** the risk from one form to a more acceptable form.

Risk does not disappear: Risk management strategies such as insurance, contingency planning etc. can mitigate or transform risk, but it is never completely avoided or eliminated.

The Impact-Likelihood Matrix can be used as a guideline to help determine the most appropriate risk management strategy as shown in Figure 4.

"No matter how good we may become at assessing risk, however comfortable we may try to be with the idea of risk, the reality can still be uncomfortable. We have to step outside our comfort zone. Risks are seldom taken without any danger being involved. In fact, it is the only way forward. As former British Prime Minister David Lloyd George once said, "Don't be afraid to take a big step. You can't cross a chasm in tow small jumps."

From a speech given by Andromache Karakatsanis

Figure 4: How to Interpret the Impact-Likelihood Matrix

Objective:		Likelihood		
		Low	Medium	High
Impact on ability to achieve objectives	Significant	**Specify management responsibility.**	**Detailed management planning and attention is required.**	**To be managed by senior management with a detailed plan.**
	Moderate	**Manage by specific procedures.**	**Specify management responsibility.**	**Detailed management planning and attention required.**
	Minor	**Manage by routine procedures.**	**Manage using specific procedures.**	**Specify management responsibility.**

Communication is a risk management tool: Open communication across all staff levels using a simple, common risk language is essential to effective risk management. **Ignoring risk is not an acceptable risk management strategy.** No one likes surprises and few people want to hear bad news. It is therefore not easy at times to communicate risks as they occur. However, to develop effective action plans it is crucial to communicate risks as soon as they are anticipated or known. Your organization will then be able to take appropriate actions to plan and manage risk more effectively.

Testing the Risk Management Strategy: If the risk were of a high priority, testing the strategy in advance would be advisable. Common methods include:

- Scenario testing / stress testing: (What if a particular event happened?)
- Back-testing: What if we had implemented this strategy last year? How would our results look?
- Sensitivity Analysis: What if we change one variable in our risk assessment e.g. increase the likelihood?

Risk Hedging with Real Options

Real options are non-financial options that give the right but not the obligation to the holder to take some action in the future. For example, a contract cancellation clause is a real option. As with a financial option the value of that clause to management's strategic flexibility increases as uncertainty increases. By providing more strategic flexibility, a real option limits threats or downside risk while allowing for opportunity in the future.

Real option analysis can be a valuable decision-aid when alternative strategies are being compared. It encourages managers to create value or flexibility when they make decisions and to clearly identify the uncertainties or risks they are hedging with the real option. Event trees, can be a useful tool for valuing options for the management of strategic or policy risks.

Other types of real options include:

- Learning options: e.g. pilot studies
- Growth options: investment that will allow future opportunities e.g. partnering, infrastructure
- Cancellation options: opportunity to change strategic direction or choose another alternative
- Defer: opportunity to make a decision at a later date
- Compound option: multiple options of the types listed above

The Office of the Controllers risk management training includes examples of real options and the use of an event tree.

Step 5

How to Monitor Risk:

Regular monitoring of risks is important:

- To be accurate. Risk assessments and risk tolerance can change over time,
- To determine the success of risk management strategies and the need for improvement,
- To determine the impact of new events, and evaluate the effectiveness of strategies
- To improve risk management strategies and methods: a learning loop.

Very few risks or circumstances remain static over time. The risk management process is more effective when risk assessments, risk tolerance levels, and the success of risk management strategies are reviewed and monitored regularly or with the prompting of particular events. The risk profile can be a helpful tool for determining the frequency of monitoring (yellow and red zone risks require more attention. As the risk management process is integrated into the reporting, planning and performance measurement activities of the ministry (or agency), regular reports should be produced that will signal the level of risk and indicate whether it is within the bounds of the defined risk tolerance.

Risk monitoring can build on current processes such as internal audit and business planning. However, as your organization's capabilities for risk management grows, or significant risks are identified, a risk management function may be appropriate. Ideas for enhancing risk monitoring include:

- Integrate risk management into the business planning process;
- Form a risk committee: Meet regularly to review risk reports and compare the performance, review the effectiveness of risk management strategies, and risk tolerance levels;
- Build a risk management dashboard. Regularly monitor identified risk assessments against risk tolerance levels;
- Integrate risk management into the performance measurement system. Monitor organizational and individual performance as part of a scorecard.

We must always view risk taking as a learning experience, even when the results do not turn out as we had hoped or expected. More often than not, the risks prove to be well worth taking….. Some of you may remember...we located the Registrar General's Office from Toronto to Thunder Bay…. there were backlogs, lost records… eventually the Ministry increased productivity by 40%…the relocation initiative won an IPAC Gold Medal of Achievement.

From a speech given by Andromache Karakatsanis

Glossary of Terms:

The following terms are used throughout the Office of the Provincial Controller's Risk Management Framework. The sources include: The Canadian Institute of Chartered Accountants *Guidance on Control (1995), Guidelines for Managing Risk in the Australian Public Service* (1996); *Protecting the Public Interest* produced by the Inspection, Investigation and Enforcement Secretariat of the Province of Ontario (Draft 2001), *Integrated Risk Management Framework* produced by Treasury Board Secretariat of the Government of Canada (2001), and Risk Publications: *Corporate Risk* (1999), *Asset and Liability Management* (1998).

Go to: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Accountability — Accountability is the obligation to answer for results and the manner in which responsibilities are discharged. Accountability cannot be delegated.

Back-testing — A method for validating a strategy or a model by feeding it historical data and comparing the results with historical reality. E.g. What would have happened had we done this five years ago?

CoCo — CoCo stands for criteria of control: a risk management tool developed by the Canadian Institute of Chartered Accountants to assist managers and internal auditors in designing, assessing and reporting on control systems of an organization. See Control.

Consequence — Consequence is the outcome of an event or situation expressed qualitatively or quantitatively, being a loss, injury, disadvantage or opportunity.

Control — Those elements of an organization (including its resources, systems, processes, culture, structure and tasks) that taken together, support people in the achievement of the organization's objectives.

Correlation Matrices — Statistical constructs used to determine the degree that various factors are related to one another. A tool that can be used as part of risk assessment.

Cost The cost of activities, both direct and indirect, involving any negative impact, including money, time, labour, disruption, goodwill, political and intangible losses.

Credit Risk The risk that a loss will be incurred if a counterparty to a transaction does not fulfil its financial obligations in a timely manner.

Decision Tree A pictorial representation of the relationship between decisions, risks and outcomes. It can be used as a tool to evaluate alternative strategies and make decisions. The decision tree breaks down a series of events and decisions into smaller, simpler, more manageable, independent segments. These segments are represented as branches of a tree. The lattice concept of the tree is also used to analyse events (see event tree) and to assess risk paths that are dependent on one another.

Delphi Technique The use of a group of knowledgeable individuals to arrive independently at an estimate of the outcome of an uncertain situation.

Derivative A term often applied to financial instruments whose value changes with the value and characteristics of another market variable (the underlying). Derivatives are often used to hedge financial market risks.

Ecological Risk Risks to the environment including air, water earth, forests.

Enterprise Risk Management See Integrated Risk Management

Environmental Risks Environmental risks are usually determined by sources outside of the control of the organization. They are also sometimes referred to as “external risks” facing an organization. Examples of environmental risks would include changes in the economy, demographics and in federal policy.

Event An incident or situation that occurs in a particular place during a particular interval of time.

Event Tree Analysis A method of illustrating and analysing the relationships between a sequence of outcomes that may arise over time. (similar to a decision tree)

Financial Market Risk Risks relating to changes in prices of tradable macroeconomic variables such as foreign exchange rates, interest rates and commodity prices. Governments are exposed to financial market risk in terms of their borrowing and investing activities and are indirectly exposure to industry sectors that are also exposed to these markets e.g. tourism's exposure to the US dollar, or mining industry exposure to the price of gold.

Financial Risks Financial risks are risks that relate to losing/gaining financial resources. Financial Market Risk is a type of financial risk.

Frequency A measured likelihood expressed as the number of occurrences of an event in a given time. See Probability

Hazard: A risk that is a threat. The term is often used in reference to health and safety risks with the potential of causing damage or harm. See Risk

Health And Safety Risk Physical hazards to citizens' property as well as opportunities for improved security and well being. See Hazard

II& E Investigations, Inspections and Examinations Secretariat of the Province of Ontario. A multi-ministry task force established to look at risk management practices pertaining to hazards, or threats to health and safety.

Impact-Likelihood Matrix A tool for subjectively mapping the assessment or measurement of a risk in terms of its likelihood and impact on objectives. The matrix also suggests risk management strategies appropriate to the level of risk.

Information Risks Information risks are risks that relate to the access to or the use of inaccurate, irrelevant or untimely information; unreliable systems; and inaccurate or misleading reporting in support of decisions. The ability to forecast future costs based on historical trends would be an example of information risk.

Integrated Risk Management — Integrated risk management is a continuous, proactive and systematic process to understand, manage and communicate risk from an organization-wide perspective. It aggregates all types of risk across from all Ministries and Agencies, and monitors and manages risk on a (portfolio) comprehensive basis. It is practiced widely in the private sector, but is still viewed by many public sector risk managers as a future goal. (See the federal government Integrated Risk Management Framework at http://www.tbs-sct.gc.ca)

Legal Risk — The risk associated with the judicial process and contract law.

Likelihood — A measurement of how often and probable an event might occur. It is often used as a synonym for probability and frequency especially in a qualitative context. See Probability

Loss — Any negative consequence, financial or otherwise.

Mitigate — The action of reducing or minimizing the severity of the impact or likelihood of a risk or an event. Risk mitigation usually consists of management strategies such as: insurance, transfer to a more acceptable risk, etc.

Modern Controllership — Modern Controllership is a set of management functions that ensures: ethical behaviour, conscious managing of risks, clear lines of accountability, stewardship of resources, and reporting and evaluation of results against stated objectives.

Monitor — To check, supervise, observe critically, or record the progress of an activity, action or system on a regular basis in order to identify the need for change.

Net Present Value — A technique used to assess the current worth of future cashflows by discounting those future cashflows at today's cost of capital.

Objectives — Objectives can be defined as goals. Every ministry, [and agency] division, department and group will have its own specific sub-set of objectives. Explicit objectives are those stated in the business plan of the Ministry [or

agency]. Implicit objectives are those inherent or assumed in any organization. For example, the safety of all employees in the workplace is an example of an implicit objective of the OPS

OOC Office of the Controller

Operating Risks Operating risks are risks that relate to doing the right things the wrong way. For example, asking employees to practice risk management practices without providing training to the employees would be an operating risk.

Operational Risk Risk pertaining to how we deliver services. These would include risks involving human resources, controls and processes.

Opportunity A risk with a positive outcome. See Risk

Opportunity Cost The value of an action that could have been taken if the current action had not been chosen.

OPS Ontario Public Service

Outcome The desired benefit of a program (event).

Output An output is what is produced by a program or event.

Political Risk Risk pertaining to an impact on the Government, i.e. a change in government policy.

Probability The likelihood of a specific outcome measured by the ratio of the specific outcomes to the total number of possible outcomes. Probability is expressed as a decimal number between 0 and 1, with 0 representing an impossible outcome and 1 indicating the certainty of an outcome.

Program Manager For the purposes of this Framework, a risk manager is an OPS employee who is involved in the delivery of a government program.

Quality Service Model The OPS Quality Service Model identifies seven cornerstones as key to its ongoing effectiveness as an organization. They provide the OPS with an approach to ensure long-term success in being an effective public service organization: leadership, customer and citizen focus, people focus, planning, process, partners, delivery agents and suppliers, and most importantly – results.

Real Options A real option is a non-financial option that gives the holder the right but not the obligation to take an action in the future. e.g. cancellation features in contracts.

Residual Risk The remaining level of risk after a risk management strategy has been implemented.

Risk A risk is a potential opportunity or threat to an organization's ability to meet its objectives.

Risk Acceptability A term used in Hazard Risk Management. Acceptable risk is a level of risk that senior management is willing to accept or tolerate. The term is commonly used in hazard risk management in reference to risk tolerance levels that are set in legislation or standards outlined in a policy. **See Risk Acceptance**

Risk Acceptance A term used in hazard risk management meaning an informed decision to accept the likelihood and the impact of a particular risk.

Risk Adjusted Performance Measures A measurement of performance optimisation. Risk adjusted performance measures (RAPM) consider the cost of risk management in determining performance.

Risk Analysis A systematic use of available information to determine:

- How often specified opportunities / threats to objectives (risks) may occur;
- The impact of specified risks on the organizations ability to meet its objectives;
- The timing of the risk; and
- The source and relation of the identified risk to other risks.

Risk Assessment The process used to determine risk management priorities by evaluating and comparing the level of risk against pre-determined standards, target risk levels or other criteria.

Risk Control	The process of integrating findings from the risk assessment with technical, financial, policy, and non-technical concerns of stakeholders, to develop and select suitable risk control actions, and implementation of these actions. Risk control actions include implementation of policies, standards, procedures and physical changes. (Some other frameworks use the term risk management where this document uses the term risk control.)
Risk Evaluation	The process by which risks are examined in terms of costs and benefits, and evaluated in terms of acceptability of risk considering the needs, issues and concerns of stakeholders.
Risk Hedging	A risk management strategy that offsets an existing risk (fully or partially). Often a hedge transfers the risk to another entity such as an insurer or a counterparty.
Risk Identification	The process of determining what can happen, why and how.
Risk Management	Risk management is the active process of identifying, assessing, communicating and managing the risks facing an organization to ensure that an organization meets its objectives.
Risk Management Process	A systematic decision and management tool that consists of a five-stage cycle: clarify objectives, identify risk, assess (measure) risk, plan and take action to manage risk, and monitor risk,
Risk Manager	For the purposes of this Framework, a risk manager is an OPS employee who is responsible for, or involved in implementing various aspects of the risk management decision-making process.
Risk Receptor	A term used in Hazard Risk Management. An entity or individual that can be impacted as a result of an activity undertaken by that entity or individual, or by others. Examples include members of the public, businesses and their employees, the OPS and its employees, and the environment.
Risk Reduction	A selective application of appropriate techniques and management principles to reduce either the likelihood of an occurrence or its impact, or both.

Risk Tolerance Risk tolerance is the degree of comfort with various levels of risk.

Risk Transformation A risk management strategy that changes a risk from an unacceptable form (or type of risk) to a more acceptable form of risk. E.g. Ministry of Health's free flu vaccine transformed operational and health risk to a budget or financial risk.

Sensitivity Analysis An analysis that examines how the results of a calculation or model vary as individual assumptions are changed.

Significant The measure of the impact of an item which would change a person's decision if they where made aware of it.

Stakeholder An entity or individual that has an interest in an activity. Stakeholders are generally also risk receptors and include individuals, groups or organizations who may affect, be affected by, or perceive themselves to be affected by, a decision or activity.

Stochastic Modelling Stochastic modelling is a statistically based method of modelling relationships mathematically to simulate what might happen in a given time period. It is used in the OPS by science, economics, treasury and engineering teams.

Strategic Risks Risks that relate to doing the wrong thing. They are generally brought about by uncertainties that may be driven by government policy, budget, or a change in stakeholder requirements.

Stress-Testing An analytical method that evaluates a risk under a range of scenarios. For example, as a risk management practice bridge and highway designs are stress-tested mathematically to highlight structural weaknesses. The value of a portfolio of financial instruments is stress-tested to see the change in value under worst case scenarios.

Uncertainty A condition where the outcome is not known.

Undesirable Event An event that brings out the hazard and results in an adverse consequence for the risk receptors.

VaR A measurement of risk. Value at risk (VaR) is the probabilistic bound of losses (usually financial market losses) over a given period of time expressed in terms of a specific degree of certainty (or confidence interval). VaR is widely used by financial institutions around the globe and accepted by regulatory agencies as a methodology for determining reserve requirements.

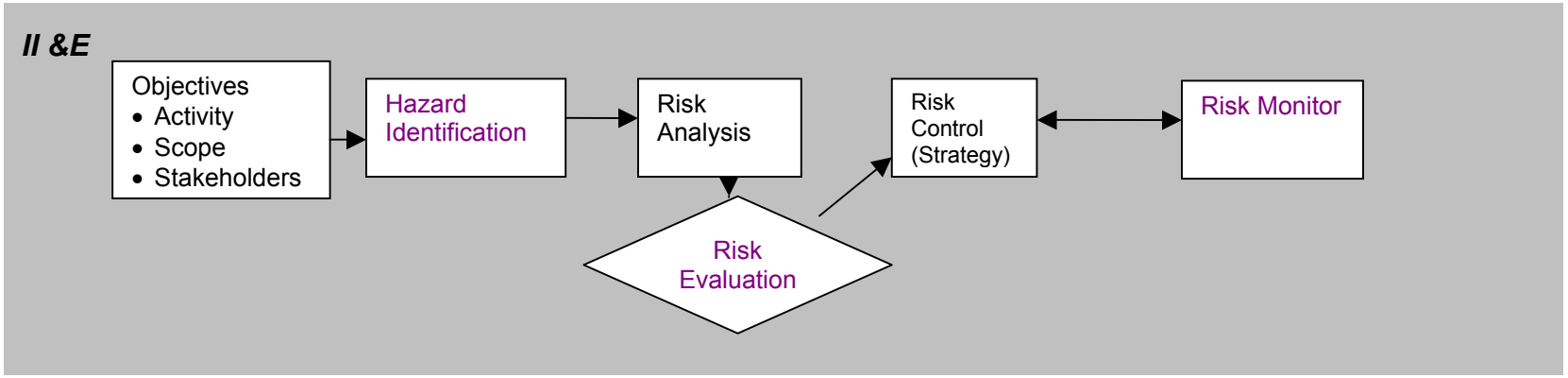
Appendix 1: OPS Hazard Risk Management Process for II&E

Note: This is a summary of "Draft Risk Management Framework: Protecting the Public Interest" developed by the Inspections, Investigations and Enforcement (II&E) Inter-ministerial Working Group, who were organized to develop options for increasing the effectiveness and efficiency of government II&E activities. We have changed the terms to make them consistent with the OPS Risk Management Framework Glossary and noted the differences. This framework is consistent with those advocated by the World Trade Organization and International Standards Organization , for hazard risk management activities. ***If the program you manage does not involve inspection, investigation or examination activities for regulatory compliance, there may be limitations to its application to your program.*** *Welcome to model risk!*

Consistent with the OPS Risk Management Framework from the Office of the Controller, the risk management process for inspection, investigation, and enforcement activities (II&E) begins with the objectives of the Ministry or government. For II& E activities the objectives are stated in legislation or enforceable standards relating to the risk or activity. The objectives precede the definition of the activity scope. Although objectives are often assumed for these activities, it is a good practice to articulate them in the risk management process to ensure consistency.

The generic risk management process for the OPS II&E is illustrated in Figure 1. The example being used is that of a risk to public safety: Truck transportation. The Highway Safety Act and the Transportation of Dangerous Goods Act provide the legislative authority and ministerial objectives: Key steps are as follows:

Figure 1



1. Initiation

- identify the activity, or the issue or problem to be managed;
- Identify the stakeholders/ risk receptors
- Clarify Objectives

Program Level Example: The decision to focus II&E activities on transportation of dangerous goods or transportation of goods in general. The stakeholders would include the public, the carriers, and the Ontario Ministry of Transportation. The objective at risk is the intention of the Highway Safety Act and the Transportation of Dangerous Goods Act: to protect citizens on highways and from harmful substances on the highways.

2. Scope Definition:

- Define the scope of the activity (including geographical boundaries of responsibility, applicable legislation, the variables and activities that need to be taken into account, the physical characteristics of the system).
- Identify the interests and concerns of stakeholders.

Example: At the program level, the road system within the Province of Ontario would be the geographical scope of the system being managed with all applicable Ontario laws being part of the scope. The carriers operating within the Province, and their characteristics -, such as maintenance and driver training practices - are also part of the scope.

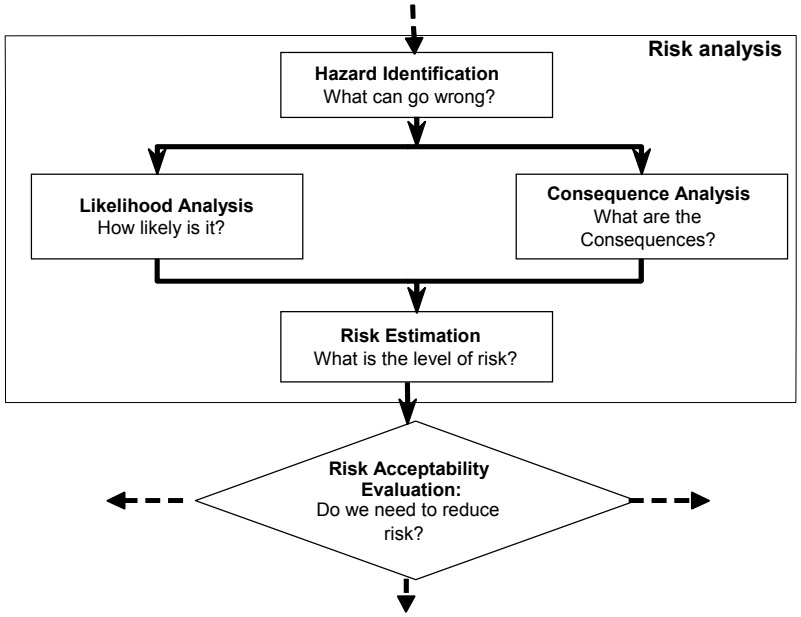
At the program level the needs of the travelling public include safety (i.e., not to be affected by an undesirable event related to truck transport). The needs of carriers include safety and on-time delivery while minimizing cost. The needs of MOT personnel include safety of the travelling public while minimizing cost of II&E.

For the district manager at the field level, the scope includes the road network within his or her area of responsibility, the general traffic levels at each section of the road network and the carriers and their driver training and maintenance practices. At the field level one of the primary needs of the travelling public is safety. Truck driver needs include safety and on-time delivery while minimizing driving distance and time on the road. MTO personnel needs include safety of the travelling public and travelling MTO personnel, while maximizing the returns of II&E efforts.

3. Risk Assessment: Risk assessment includes risk analysis and risk evaluation, as shown in Figure 2

Figure 2

II & E Risk Assessment Process



3.1 Risk Analysis: the process of identifying "what can go wrong" (in terms of potential hazards and undesirable events, or deviations from what is intended); and analyzing potential causes, likelihood, and consequences of these undesirable events, to develop an understanding of their significance for the stakeholders/ risk receptors of concern.

Risk analysis consists of several steps.

- Hazard Identification: what can go wrong (the threat to achieving objectives). The conditions or factors inherent in the activity that is being analyzed, which, if not proceeding as planned or if deviating from intended norm can lead to adverse impacts on the wellbeing of one or more risk receptors.

Example: The primary "undesirable event" is a truck "accident" ("collision' or "upset" in technical terms). For an inspector, an "undesirable event" could also be missing trucks that have a higher likelihood of getting involved in an accident particularly those, which could cause serious damage because they carry hazardous materials. For example, in the transportation of chlorine, the toxic properties of chlorine constitute the inherent "hazard." Its release from containment is the "undesirable event."

3.2 Likelihood and Impact (Consequence) Analysis

Likelihood is generally expressed in terms of "events per year," "annual probability of event," or "probability of event during the lifetime of the activity." The likelihood analysis step would consist of an examination of the potential causes of accidents - such as driver fatigue, poor maintenance, excessive speed, insecure loads, behaviour of other drivers and road conditions - and an examination of historical data culminating in an understanding of the likelihood of the undesirable events

Historical data can be examined to develop an understanding of the likelihood of a given type of undesirable event (e.g., accident), but relying only on this data will force the regulator to remain in a continuously reactive mode. Moving towards a proactive mode of preventing undesirable events that are one of the primary purposes of implementing risk management practices. In order to be proactive in II&E activities, the primary causes of different types of undesirable events (e.g., accidents) need to be understood, so that the necessary precautions can be built into II&E practices to help prevent events from happening.

Many technical tools are available for analyzing causes and likelihood of undesirable events, such as "fault and event trees." Fault or event trees are logic diagrams that are used for tracking the series of events that might lead to the undesirable event, or that might follow it.

Impacts or consequences to achieving the regulatory objective should be measurable in commonly understood terms - such as health impact (e.g., fatality, injury, illness of people), environmental impact (e.g., loss of resource use, species endangered), and /or financial cost (e.g., asset damage, lost productivity, missed deadlines). Many technical tools are available for analyzing consequences, depending on the particular activity being analyzed.

3.3 Risk Estimation

Risk estimation generally involves either or both: a ranking of the different undesirable events using a likelihood - consequence - risk matrix (see

below); or a calculation through the simple formula

Risk Estimation = Likelihood x Impact.

There is a myriad of potential consequences of a truck accident. They include: public or employee (truck driver) fatalities or injuries from direct vehicle collision or the impact of flying wheels damage to infrastructure spills o1 transported goods (some of which could be hazardous materials with subsequent public and environmental impacts road closures etc.

The consequence analysis step would consist of the recognition of these consequences and an examination of (heir magnitude (e.g., the impact zone of a fireball from a propane truck hole or the impact zone of a cloud at ammonia released from a truck).

This formula is the basis of many quantitative risk analysis methods. It needs to be applied to each potential undesirable event. The total risk of a given activity can be estimated by adding together the risk from each event. A typical risk-ranking matrix is shown in Figure 3. This is a 3x3 matrix for demonstration purposes, and perhaps the simplest in common use.

Figure 3: Typical Risk Ranking Matrix

Objective:		**Likelihood** (probability)		
		Low (1)	Medium (2)	High (3)
Impact (consequences)	Significant (3)			
	Moderate (2)			
	Minor (1)			

Each undesirable event is assigned to a likelihood category (from lowest to highest likelihood rated 1-3), and to an impact category (minor, moderate, significant, in increasing impact rated 1-3). Each undesirable event identified in the hazard identification step can be thus evaluated by putting it into this matrix, and ranked relative to each other for prioritization purposes. Recognizing that different outcomes (each with its own impact) of a given event may have different probabilities of occurrence after the event occurs, we also sometimes use a second likelihood

categorization, this time for the likelihood of a given consequence.

Risks with high-risk estimates are given more attention in developing risk control measures to reduce the likelihood and/or impact. A table such as the one above can be used to prioritize risks. However, this tool only accommodates one objective. In the case of enforcing regulatory compliance the number of objectives are frequently narrowed to the objective of the legislation and the cost of enforcement. **Non-hazard risks tend to have multiple objectives. This limits the applicability of the tool to other types of risk.**

To graphically display the above information a risk map is often used.

Figure 4: Risk Map

Objective:		**Likelihood** (probability)		
		Low (1)	Medium (2)	High (3)
Impact (consequences)	Significant (3)			
	Moderate (2)		Event 2, Receptor 4	Event 1, Receptor 3 Event 1, Receptor 2
	Minor (1)	Event 1, Receptor 1 Event 2, Receptor 2	Event 1, Receptor 4 Event 2, Receptor 1 Event 2, Receptor 3 Event 1, Receptor 4	

These graphs are especially valuable if actual quantitative data (with appropriate units) are available for the likelihood and consequence of each event. If such detailed information is not available, representative values can be assigned to each likelihood and consequence category. Each event can then be plotted on the risk map. For most day-to-day decision making, a simplified risk map showing the number of events in each cell of the matrix will be sufficient.

Sometimes, especially if a detailed quantitative analysis and a cost-benefit analysis are being done, it is more useful to present the above information in terms of "likelihood of exceeding or equaling a given consequence." An example is shown in Figure 5 Such a graph is commonly known as a "risk profile."

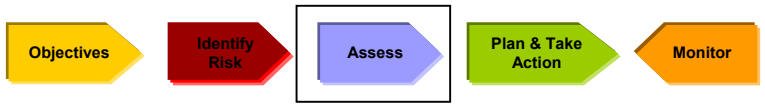
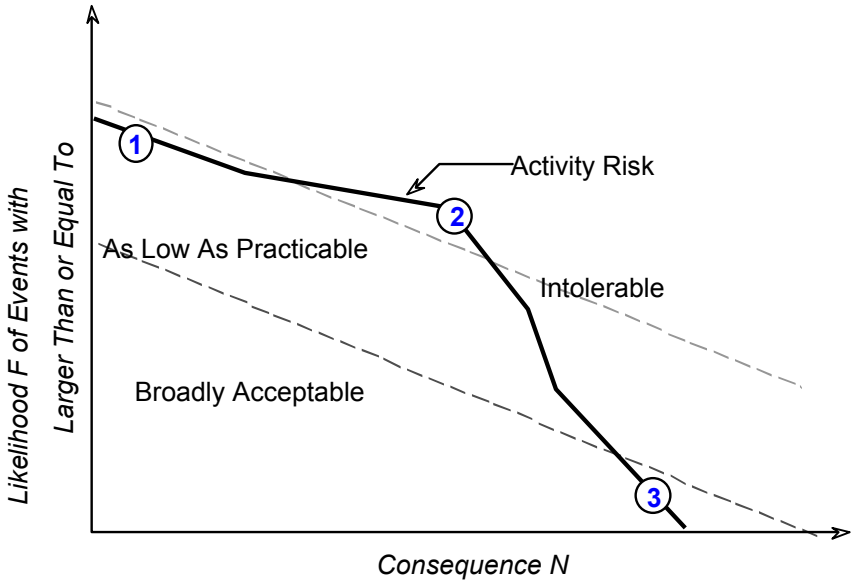


Figure 5

Representation of Risk – Risk Profile



These graphs can be used to compare different alternatives or to demonstrate how much risk reduction can be achieved through different sets of risk control measures by applying the "continuous improvement loop" repetitively. In many jurisdictions, public risk acceptability guidelines are established using risk profiles, as shown in Figure 4. The basis for establishing such guidelines is described in the Risk Acceptability Evaluation section of this document.

1. Although probability is high, consequence is low, and so we would try to reduce the risk further only if it is practicable.

2. Combination of probability and consequence is intolerable.

3. Although consequence is high, the probability of experiencing such consequence is sufficiently low to be broadly accepted.

4. Risk Acceptability Evaluation

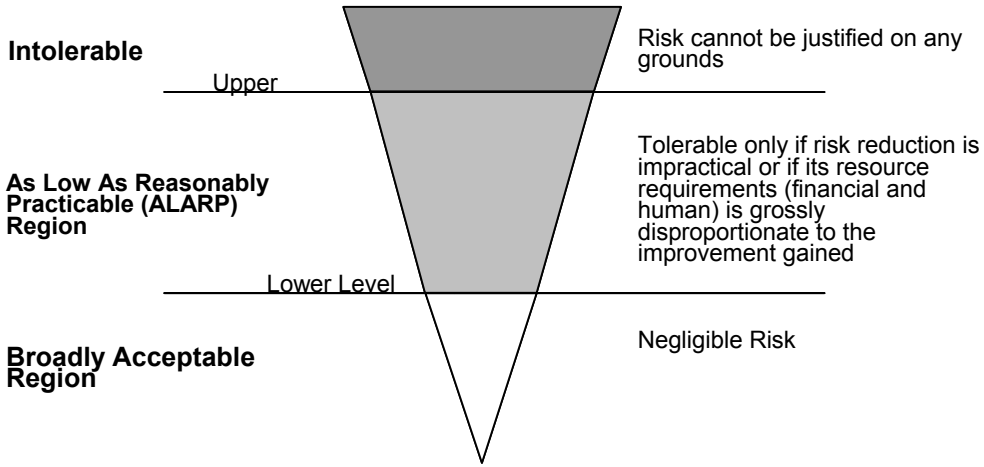
In this step the significance of undesirable events is evaluated in order to assess whether a reduction in their likelihood and/or impact (consequence) is needed. If the risks are deemed acceptable, the identified risks are monitored on an ongoing basis. If it is decided that the risks are unacceptable, additional risk control measures are developed. The basis for risk acceptability (or tolerability) is shown in Figure 4.

The risk acceptability evaluation assumes that there are essentially two levels of risk demarcating three regions:

- Risk above the Upper Level would be considered too high by most members of the public who would want it to be reduced.
- Risk below the Lower Level generally would not be of much concern to the public.
- In the middle there is a grey area where risk is tolerated only if risk reduction is impractical or its costs are disproportionate to benefits. This region is commonly known as the ALARP (As Low As Reasonably Practicable) region.

Figure 6

Basis for II&E Risk Acceptability



While this approach to dealing with risks is accepted generally, there are difficulties in practical applications namely, the balancing of multiple objectives and the links between risks in government.

5. Strategy: Risk Control and Continuous Improvement

Risk control actions are measures to reduce likelihood, consequences, or both. In the truck transportation example, the district manager is trying to decide whether to apply resources to 'new' or to "out-of-province " operators.

Legislation is one of the risk control measures a government has at its disposal. Risk-based legislation puts the onus on owners and operators of risk sources by specifying broad performance expectations and requiring risk management systems. Legislation can also specify the types of risk control measures that should be in place - such as the level of personnel training, contingency plans, buffer zones between risk sources and risk receptors, and insurance requirements.

In the II&E context, risk control measures can vary from introducing new regulatory programs; to training inspectors to wear personal protective equipment appropriate to the hazards in the industrial facilities that they routinely inspect. It is important to delineate clearly the costs of introducing new risk control measures while they are being developed.

Implementation of any new risk control measure changes the characteristics of the system being managed and its risk characteristics. This loop back to scope/system definition constitutes the continuous improvement loop of a successful management system.

It is important to document a justification of risk control actions in risk management. This includes documenting any analyses that are undertaken, and how stakeholder considerations are taken into account. Such documentation is invaluable for monitoring progress in risk management and for due diligence defense if something goes wrong in the process.

6. Risk Monitoring

At some point in the continuous improvement iteration, the risk acceptability evaluation step will indicate that the activity to be managed can continue "as is," or a new activity can be implemented. This takes place when the residual risk that remains after implementation of risk control measures is deemed to be acceptable. The situation must be monitored on an ongoing basis so that unexpected deviations or undesirable events do not occur while the activity is being carried out. Risk monitoring is the process of monitoring whether all of the risk control measures are implemented and functioning as intended, and reevaluating their effectiveness from time to time. Audits are considered part of risk monitoring efforts. Findings from the monitoring step in the risk management process feed back into the risk evaluation step. At this point it might be

necessary to react to a changing situation and to look at new control measures. This leads to the risk control step of the risk management process.

7. The Learning Loop

If, at the risk acceptability evaluation step, it is not possible to decide whether to carry on with an activity or to add new control measures, this is an indication that not enough information is available. In this case, the next step is to broaden the scope, and perhaps the stakeholder base, and to re-do the analysis with more detail.

Example: The inspection activity of the OPS can be considered as a risk monitoring activity of government. An MTO officer inspecting the brakes of a truck is carrying out a risk monitoring activity. If (s)he detects a fault and orders the truck off-the-road, this is a risk control activity.

One cause of truck accidents can be driver fatigue. An officer might look for signs of driver fatigue or choose not to inspect a vehicle belonging to a carrier with a known track record of established minimum driver-rest-hour policies.

Information about carrier corporate practices might be established more effectively by inspecting carrier corporate risk management systems rather than individual vehicles keeping in mind that the Level of actual driver Implementation of such systems con only be established through inspection of individual vehicles. Risk monitoring includes keeping d record of truck accidents their causes and consequence Location truck operator, etc. and analyzing trends.

In the truck transportation example above, the ministry of Environment was not considered one of the stakeholders. When it is realized during the risk analysis step, that some of the undesirable events such as spill of d hazardous cargo might lead to environmental Impacts, the "teaming loop" would be implemented quickly and the MOE would be added as one of the stakeholders. MOE's expertise would be included in the analysis and in new program development. This also holds true for emergency response organizations which would be included in risk control activities in a race to limit the consequences of such an event.

To obtain a complete copy of the Risk Management Framework for II &E Activities in the OPS please contact: II&E Secretariat (416) 326-9622

Appendix 2: Where to Learn More (Resources)

Behavior and Risk

Harmond, John S. Keeney, Ralph L. Raiffa, Howard	*Smart Choices,* Harvard Business School Press,1998
Kahneman, Daniel Tversky, Amos (Editor)	*Choices, Values and Frames*
Slovic, Paul	*The Perception of Risk* (Risk, Society and Policy Series) January 2001)

Credit Risk

Caouette, John B. Altman Edward I., Narayanan, Paul	*Managing Credit Risk : The Next Great Financial Challenge* (1998),John Wiley & Sons
Risk Publications	*Credit Risk Models and Management*

Decision-making

Golub, Andrew Lang	*Decision Analysis: An Integrated Approach,* John Wiley & Sons, 1997
Jones, Morgan D.	*The Thinker's Toolkit,* Times Business –Random House, 1995

Energy Risk

Risk Publications	*Energy Modelling and the Management of Uncertainty*

Financial Market Risk

Alexander, Carol, Hull John C. (Editor),	*Risk Management and Analysis : New Markets & Products* (Wiley Series in Financial Engineering) 1998
Best, Philip	*Implementing Value at Risk* (Wiley Series in Financial Engineering 1999)
Borodovsky, Lev Lore, Marc Editors	*The Professional's Handbook of Financial Risk Management,*
Chriss, Neil A.	*Black-Scholes and Beyond Interactive Toolkit : A Step-By-Step Guide to In-Depth Option Models* May 1997
Crouhy ,Michel, Mark Robert, Galai, Dan	*Risk Management, 2000* - McGraw Hill Professional Publishing

Dowd, Kevin	*Beyond Value at Risk : The New Science of Risk Management* (Wiley, 1998)
Fabozzi, Frank J.	*Fixed Income Mathematics: Analytical & Statistical Techniques* (October 1996), Irwin Professional Publishing
Gastineau Gary L. Kritzman Mark P.	*Dictionary of Financial Risk Management* (Frank J. Fabozzi Library) 1999
Hull John C.	Options, Futures, and Other Derivatives 2000, Prentice Hall
Jorion, Philippe	FRM Handbook 2001/2002 Wiley/GARP Risk Management Library
Jorion, Philippe	*Value at Risk* (2nd Edition, December 2000), McGraw Hill
Mark, Robert	*Optimal Firm-wide Risk Management: The Whole Company Approach,* Risk Publications included in Risk Management for Financial Institutions
Neftci, Salih N.,	An Introduction to the Mathematics of Financial Derivatives 1996
Peters, Edgar E.	*Patterns in the Dark: Understanding Risk and Financial Crisis with Complexity Theory* 1999
Ravidan, K.	*Customized Derivatives,* McGraw-Hill, 1998
Risk Publications	*Corporate Hedging In Theory and Practice Lessons from Metallgesellschaft*
Risk Publications	*Financial Risk and the Corporate Treasury New Developments in Strategy and Control*
Risk Publications	*Derivatives & the Internal Auditor Key Topics and Concerns*
Schwartz, Robert, Smith Clifford W., Jr	*Derivatives Handbook* (May 1997) John Wiley & Son
Schwartz. Robert J. (Editor),	*Derivatives Handbook : Risk Management and Control* (Wiley Series in Financial Engineering)
Smithson, Charles W. Smith, Clifford W	*Managing Financial Risk: A Guide to Derivative Products, Financial Engineering and Value* (3rd edition, July 1998), McGraw Hill
Crouhy, Michel et al	*Risk Management*
Dupire, Bruno Editor: Risk Publications	*Monte Carlo Methodologies and Applications for Pricing and Risk Management,* Risk Publications

Hazard Risk Management

Barass, Karen J.	*Clean Water (Earth at Risk),*1992
Calow, Peter ed.	*Handbook of Environmental Risk Assessment and Management*, 1998
Fleisher, Beverly	*Agricultural Risk Management*, 1990
Gratt, Lawrence B.	*Air Toxic Risk Assessment and Management: Public Health Risk from Normal Operations 1997*

II&E Working Group — *Protecting the Public Interest,* 2001

Kipp, Jonathon — *Emergency Incident Risk Management,* 1997

Kolluru, Rao — *Risk Assessment and Management Handbook: For Environmental Health and Safety* , 1996

Levitt, Alan M. — *Disaster Planning and Recovery: A Guide for Facility Professionals*, 1997

Louvar, Joseph — *Health and Environment al Risk Analysis: Fundamentals with Applications*

Regester, Michael — *Risk Issues and Crisis Management,* 1998

Turnberg, Wayne L. — *Hazardous Waste: Risk Assessment, Policy and Management* ,1996

General Interest

Clarke, Lee — *Mission Improbable : Using Fantasy Documents to Tame Disaster* , 2001

Daniell, Mark — *World of Risk Next Generation Strategy for a Volatile Era*, John Wiley & Sons Ltd

Dembo, Ron S. Freeman, Andrew — *Seeing Tomorrow : Rewriting the Rules of Risk*

Jeanrenaud, Claude Soguel Nils C. (Editor), — *Valuing the Cost of Smoking -Assessment Methods, Risk Perception and Policy Options* (Studies In Risk And Uncertainty Volume 13)

History of Risk

Bernstein, Peter L. — *Against the Gods: Remarkable Story of Risk*

Hardy, Charles O. — *Risk & Risk-Bearing,* The Institute of Economics, Risk Publications

Information Risk

Peterson, Mark A. — *Computer Related Risks,* 1995

Peltier, Thomas R. — *Information Security Risk Analysis*

Integrated Risk Management

Canada, Treasury Board — *Integrated Risk Management Framework,* 2001

Culp, Christopher L. — *The Risk Management Process: Business Strategy and Tactics*

DeLoach, James — *Enterprise-wide Risk Management*, FT Prentice Hall, 2000

Embrechts, Paul, Editor — *Extremes and Integrated Risk Management* , Risk Publications

Harris-Jones — *The Management of Corporate Risk*, Association of Corporate Treasurers

Parr Rud, Olivia	*Data Mining Cookbook: Modeling Data for Marketing, Risk and Customer Relationship Management*
Pickford, James	*Mastering Risk-Part 1, Concepts,* FT Prentice Hall 2000
Risk Publications	Real Options and Business Strategy Applications to Decision Making
Risk Publications	*Corporate Risk Strategies & Management*
Risk Publications	*Game Choices The Intersection of Real Options Game Theory*
Risk Publications	*Risk Budgeting*
Shimpi Prakash A. (Editor)	*Integrating Corporate Risk Management* (January 2001)
Vose, David	*Risk Analysis: A Quantitative Guide*

Operational Risk Management

Beroggi, Giampiero Wallace, William A.	*Operational Risk Management - The Integration of Decision, Communications, and Multimedia* 1998
Marshall, Christopher	*Measuring and Managing Operational Risks in Financial Institutions: Tools, Techniques and Other Resources* (2001) by
Saunders, Anthony	*Financial Institutions Management: A Modern Perspective* (2000, 3rd edition), McGraw Hill

Project Risk Management

Wideman, R. Max Dawson, Rodney J. (Editor)	*Project & Program Risk Management : A Guide to Managing Project Risks and Opportunities*, May 1998

Risk Web Links	
http://www.agrisk.umn.edu/links.asp?link=RiskMgmt	Agricultural Risk
http://www-agecon.ag.ohio-state.edu/agrisk/	Agricultural Risk
http://www.mc2consulting.com/riskart8.htm MC2 Consulting	Audit
http://www.riskmetrics.com Credit Metrics technical document	Credit Risk
http://www.public.asu.edu/~kirkwood/ Decision Analysis and System Dynamics Resources at Arizona State University	Decision Making
http://risk.ifci.ch/136160.htm Practices and Principles: G30	Financial Market Risk
http://risk.ifci.ch/RMGL.htm BIS Risk Management Guidelines for Derivatives	Financial Market Risk
http://www.noetix.on.ca/geo/geocompforfire.html	Forest Fire Risk
http://www.shellglobalsolutions.com/HSE_Consultancy/hazard_products/software.htm Shell Oil	Hazard Risk
http://www.epa.gov/ORD/spc/cumrisk2.htm U.S. Environmental Protection Agency	Hazard
http://risk.ifci.ch/ International Finance & Commodities Institute	Institution

http://www.rims.org/ Risk and Insurance Management Society	Institution
www.isda.org International Swap Dealers Association	Institution
http://risk.ifci.ch/ International Finance and Commodities Institute	Institutions
http://www.bank-banque-canada.ca/ Bank of Canada	Institutions
http://www.bus.utexas.edu/~dyerj/DA_WP/ Decision Analysis Society	Institutions
http://www.garp.com/ Global Association of Risk Professionals	Institutions
http://www.isda.org/ International Swaps and Derivatives Association	Institutions
http://www.rhsmith.umd.edu/finance/bfs/ Bachelier Finance Society	Institutions
http://www.contingencyanalysis.com/_frame/frameerm.htm Consulting Firm	Integrated Risk Mgmt
http://www.sei.cmu.edu/programs/sepm/risk/risk.mgmt.overview.html software Engineering Institute	IT risk
http://www.riskinstitute.org/ Public Entity Risk Institute	Land Use Risk
http://www.cfonet.com/ CFO Magazine	Magazine
http://www.riskpublications.com/ Risk Magazine, Journal of Computational Finance	Magazine

http://www.strategicrisk.co.uk/ Strategic Risk Magazine	Magazine
http://ifci.ch/144400.htm Bank of International Settlements	Operational Risk
http://financewise.com/public/risk.htm?id=35179	Search Engine Financewise
http://www.decisioneering.com/	Software
http://www.financeadvisor.com/finadv/software_download_confirm.shtml	Software
http://www.jpmorgan.com/businesses/deres/index.html	Software
http://www.palisade.com/	Software
http://www.riskmetrics.com	Software
http://www.treeplan.com/	Software
www.algorithmics.com	Software
http://www.riskmetrics.com/products/education/online/index.cgi?href=exploring_risk_course.html	Training On Line
http://www.zoologic.com/	Training On-Line
http://finmath.com	Training: Courses, Books

Appendix 3: Sample of a Ministry Specific Risk Assessment Template

Ministry of Education: RISK ASSESSMENT TEMPLATE

What is the name of your policy/program/project are assessing?

What is the Outcome/Result this policy/program/project is designed to achieve?

What is "at risk"? Identify the risks from the following list.

Policy Results	Customer	Partners	Leadership	People [staff]	Processes
9 Implementation	9 Program/ Client/Service Delivery	9 Delivery Partners	9 Political leadership	9 Human Resources	9 Financial
9 Budgetary	9 Taxpayer	9 Stakeholders	9 Public Service leadership	9 Ethics	9 Information Technology
9 Economic	9 Societal			9 Knowledge	9 OPS initiatives
9 Legal				9 Safety	
9 Labour Relations					
9 Other [please specify]	9 Other [please specify]	9 Other [please specify]	9 Other [please specify]	9 Other [please specify]	9 Other [please specify]

Risk Assessor	Branch	Date
Director Approval	Branch	Date
ADM Approval	Branch	Date
Business Planning and Expenditure Management Branch Review